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This is a compilation of extracts from a series of petroleum reports in captured German documents. These reports were prepared by the Armament and Economic Office of the High Command of the Armed Forces and by the Petroleum exploitation units who were responsible for investigation of all petroleum installations. 7

OKN/Rüstungs- und Wirtschaftsst (Armament and Economic Staff, High Command of the Armed Forces) published the following summary in 1942 (GNDS Document No W1/ID 2.1131).

The principal difficulty in the transportation of petroleum is the remote location of the oil resources. Shipments of crude oil and refined products were carried by various means of transportation in the following proportion:

	<u>1939 (%)</u>	<u>1942 Plan (%)</u>
Railroads	42.0	38.9
Rivers	14.0	17.6
Sea	29.0	26.1
Pipe lines	15.0	17.4

Over 50 percent of all petroleum shipped via inland waterways was crude and heating oil, almost 25 percent illuminating oil, about 10 percent gasoline, and 12 percent lubricating oil.

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## CLASSIFICATION

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The Caspian Sea-Volga River route is the most important waterway and carries most of the freight up to Saratov. Approximately 60 percent of the Volga shipments is reloaded on railroads, the remainder is usually kept in the Volga ports for local consumption. The capacity of the Volga tank farms is not sufficient. There are only 200 navigation days per year for the storage of the needed supply.

The most important and largest petroleum port on the Volga is Astrakhan, where Baku petroleum must be reloaded on the open sea, approximately 180 kilometers from the coast, because of the Volga's poor navigation conditions up to Astrakhan.

Since the use of icebreakers during the winter months was not satisfactory, construction of a railroad line from Makhachkala to Astrakhan was to assure continuous petroleum transport.

The planned expansion of the Astrakhan petroleum depots, which had a capacity of 1.2 million tons in 1937, is of great importance for the supply of the central and eastern regions of European USSR.

Farther upstream are the ports and tank farms of Stalingrad, with storage capacity of 300,000 tons; Saratov, 500,000 tons; Kamyshin; and Vol'sk, also has reloading facilities for the local cement industry, which supply the lower Volga River and Saratov regions, parts of the "Black Earth" Region, and, via railroad from Stalingrad and Saratov, the southern part of the Moscow area. The Sverdlovsk area, Tatar ASSR, Ural Region, Siberia, and northern Kazakhstan are supplied by bases located further upstream on the Volga River, such as Batraki; Kuybyshev, where reloading via railroad for supply of the Chkalov Region is effected; and Kazan, insofar as these areas are not supplied from Ishimbay-Ufa. Shipments up the Kama River into the Molotov area and from there via the railroad to Siberia will decline with the completion of the "Prikamneft" (Kama Petroleum Trust).

The most important petroleum port on the upper Volga River is Gorkiy. The capacity of its petroleum tank farms was 500,000 tons in 1937.

Farther upstream are Kineshma, a center of the chemical industry; Yaroslavl' with refineries process Emba petroleum; and Rybinsk, the uppermost large Volga River port. The Ivanovo industrial region is supplied from Yaroslavl' and Rybinsk; Moscow, via the new Moscow-Volga Canal. The capacity of the petroleum depots of Yaroslavl' and Rybinsk was approximately 700,000 tons in 1938. Leningrad and the northwestern regions are supplied from Rybinsk via the 1,050-kilometers long Mariinsk canal system, which is being enlarged but is now navigable only for tankers up to 900 tons. Petroleum shipments from the upper Volga River via the Mologa River and the northern Dvina system (Arkhangelsk) are small.

The average navigation period of the lower Volga River lasts 240 days per year; of the upper Volga River (Gorki), 195 days; and of the Kama River (Molotov), only 167 days.

While shipments to Rybinsk, Moscow, Leningrad, and various places on the upper Volga decreased during the past years, traffic increased at the ports on the lower Volga, such as Stalingrad, Kuybyshev, and Batraki, especially reloading for railroads to the eastern, northern, and central regions.

The load capacity of the Volga tanker fleet amounted to 1.3 million tons in 1938. The average speed of the Volga tanker is low. Its speed of 99-130 kilometers per day in 1934 apparently has not increased because it still takes approximately 30 days to travel 2,748 kilometers from Astrakhan to Rybinsk.

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The Dnepr River has gained in importance during the past years since its rapids were brought under control 165,000 tons of petroleum having been transported in 1937. Large petroleum depots are located in Kiev, Cherkassy, Kremenchug, and Zaporozh'ye. However, only two of nine reloading places were equipped with pumping installations for unloading petroleum directly from ships. Tugboats were temporarily employed to pump petroleum into storage tanks. Present storage facilities are not sufficient to assure the hinterland an adequate supply of petroleum from the Dnepr ports.

At present, tankers go only from Kherson to Nizhne-Petrovsk, 408 kilometers. The cities on the upper Dnepr are supplied via the railroad.

Inadequate reloading facilities at the Kherson port present additional difficulties in the use of this waterway; however, construction of new petroleum depots and the expansion of the old depots were planned to improve the situation. New depots were also to be built in Kiev, Zaporozh'ye, Dneprodzerzhinsk, Orlik, Kremenchug, and Chernigov.

In the Far East, Sakhalin petroleum is transported for approximately 1,200 kilometers, 1,000 of which are along the Amur River. Half of the Sakhalin petroleum is reloaded into river tankers at the mouth of Amur and shipped to processing plants in Khabarovsk. The navigation period lasts 185 days at Khabarovsk, and 160 days at the mouth of the Amur, but bad navigation conditions at the Amur mouth complicate such shipments.

All other inland waterways are of minor significance in petroleum transport.

The entire river-tanker fleet consisted of 504 tankers with a capacity of 1,456,000 tons in 1934. At the beginning of 1940, the People's Commissariat for Inland Navigation planned an extensive program for construction of additional tankers. The physical condition of the fleet is absolutely inadequate. Losses caused by leakage amounted to 177,000 tons in 1937.

The Volga Tanker Shipping Administration has at its disposal only half of the barges required for transportation of crude oil and derivatives. In addition, there is a shortage of barges with shallow draught for shipping oil products from Gorkiy and Yaroslavl' along the Oka and Moscow Rivers.

#### Sea Navigation

In 1939 the USSR had 89 sea-going tankers; of this numbers 25, totaling 126,280 tons, were sailing on the high seas and 64, totaling 139,340 tons, on the Caspian Sea. Most of the sea-going tankers are new, but 47 of the Caspian fleet are 30 years old.

The speed of the tankers is low; only 21 having a speed of 11 to 11.5 knots; the others, between 8 and 9 knots.

In 1934 ocean transport amounted to: 6,800 tons via White Sea and Barents Sea; 182,700 tons via Baltic Sea, including 2,300 tons for export; 6,509,200 tons via Black Sea, including 3,774,300 tons for export; 12,056,500 tons via Caspian Sea, including 34,500 tons for export; 800 tons via Sea of Azov; and 251,200 tons via the Pacific Ocean.

All exports were shipped in Soviet tankers. Of all Soviet petroleum shipments by sea 80 percent were via the Caspian Sea, half of which were from Baku to Astrakhan, 6,044,000 tons in 1939. A total of 15 million tons of shipping via the Caspian Sea was planned for 1938. Plans called for 1,565,000 tons of petroleum to be shipped by the Caspian Tanker Fleet in June 1940 (60 tankers of 131,275 gross-registered tons and 12 other tankers) as follows: 1,405,100 tons from Baku, 50,000 tons from Krasnovodsk, 114,000 tons from Makhashkala; and 1,190,000 tons to Astrakhan, 107,200 tons to Krasnovodsk, 365,000 tons to Makhashkala.

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During the first Five-Year-Plan petroleum transport on the Black Sea was concerned chiefly with export shipments, including 85 to 90 percent of all USSR petroleum exports. Subsequently, due to a decrease in the export of petroleum, the Black Sea installations and facilities were made available to inland shipping.

The most important Black Sea port is Batumi, due to its railroad connection and the Baku-Batumi pipe lines. The ports of Tuapse and Novorossiysk are also of significance. Odessa is the most important Black Sea port receiving and reloading petroleum. Part of the crude oil is processed by refineries at Odessa, and the oil products are shipped to all parts of the Ukraine and also to Leningrad. Moreover, Odessa is the most valuable port for transshipment of petroleum to Central Europe via railroad. In 1935, capacity of storage tanks within the Odessa port area amounted to 35,000 tons; storage tanks outside the port area, connected with the port by pipe lines, 12,000 tons.

Other destinations for petroleum shipments are Nikolayev and Kherson.

In the Pacific Ocean, petroleum is shipped from Moskalvo to Nikolayevsk. Due to unfavorable navigation conditions at the Amur River mouth, transshipments to ships with shallow draught have to be made on the open sea.

The Caspian-Volga Petroleum Transport Administration (Kasptanker) transported 21.2 percent less than planned of liquid fuel to the interior of the USSR during the first 5 months of 1940. Loading of gasoline, kerosene, and lubricating oil is effected by pressure of the reservoirs, not by pumps. Unloading difficulties occur particularly in Krasnodar and Makhachkala.

Gasoline shipments from Baku and Groznyy via Astrakhan between 22 June and 31 July 1941 were as follows: 33,935 tons to Kuibyshev, 32,184 tons to Kazan, 98,064 tons to Gorkiy, 75,403 tons to Yaroslavl', 96,032 tons to Rybinsk, and 48,382 tons to Ufa.

#### Railroads

Due to insufficient expansion of petroleum pipe lines and failure of waterways transportation, the railroads had to supply the refineries with most of the crude oil, in contrast to the rule that the railroads were for transportation of derivatives. However, rail shipments suffered from the manifold tasks of the Soviet railroad system.

In 1937, half of all petroleum shipments by railroad traveled a distance up to 800 kilometers; 12 percent, 800 to 1,000 kilometers; almost 25 percent, 1,000 to 2,000 kilometers; and 14 percent, more than 2,000 kilometers.

To avoid future excessive burdens railroad lines were to be relieved as follows: (1) the Transcaucasus railroad line by the construction of a third petroleum pipe line from Baku to Batumi; (2) the Makhachkala-Armavir-Rostov railroad line, by the expansion of the petroleum pipe line, running parallel to this railroad; (3) the southern part of the Rostov-Moscow railroad line by the construction of the Rostov-Voronezh spur line; (4) the Stalingrad-Moscow and Saratov-Moscow railroad lines by a more efficient use of the Volga River and the Moscow Canal; (5) the Kuibyshev-Chkalov railroad line by the development of the West Ural-Volga oil region; (6) railroads of Central Asia by developing the Fergana oil region. This last measure would also result in a production increase of the Chimion Refinery.

#### Tank Cars.

According to the "Reichsbahnzentralamt" (Central Office of the German Railroad), Berlin, the USSR has 66,000 tank cars with a maximum unit capacity

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of 40 tons. Axle changing to normal gauge is possible only on 2-axle tank cars with a capacity of 10 to 20 tons.

The enormous increase of petroleum requirements for home consumption during the last years increased demands for tank cars.

In 1939, tank cars were filled at 48 railroad stations; at 16 railroad stations the amount of petroleum loaded into tank cars exceeded 400,000 tons per station. It was planned to ship a total of 40 million tons of petroleum products, 22 million tons of light and 18 million tons of heavy products, in barrels during the last year of the Third Five-Year Plan.

#### TRANSPORTATION IN THE CAUCASUS

OKH/Fremde Heere Ost (Army High Command, Eastern Foreign Armies) surveyed petroleum transportation in the Caucasus, in April 1942, and arrived at the following estimate (GMDS Document No. H3/191).

In the USSR the average capacity of a freight train amounts to 900 tons or 1,200-1,300 tons depending upon the nature of the railroad line and type of locomotive.

A 900-ton train is able to transport 600 tons of petroleum in 2-axle cars and 700 tons in 4-axle cars; a 1,200-1,300 ton train is able to carry 800 tons of petroleum in 2-axle cars and 1,000 tons in 4-axle cars.

Transportation of 2 million tons of petroleum per year, for example, would require, approximately, the following number of 900-ton trains: 3,300 trains with 2-axle cars, 2,900 trains with 4-axle cars, and 3,000 trains with 2 and 4-axle cars, or 8 trains per day for each type. On the other hand, the number of 1,200-1,300-ton trains required would be: 2,500 trains with 2-axle cars, 2,000 with 4-axle cars, and 2,350 with 2 and 4-axle cars, or 6 trains per day for each type.

According to these calculations, on the double-track Armavir-Rostov railroad line, the transportation of 6.2 million tons of petroleum would require twenty-five 900-ton trains per day. This estimate seems to be quite accurate inasmuch as the Chief of Transportation of the Army High Command reported a daily capacity of 40 military transports by rail. According to interrogations of prisoners of war, this railroad line can accommodate up to 72 trains per day, if necessary. In addition, heavier trains, up to 2,000 tons, may be employed wherever the nature of the line permits it. Use of the superior 4-axle cars will decrease still more the number of trains required daily.

On the basis of these calculations and the estimated yearly capacity of the petroleum-hauling railroad lines, the following number of trains would be needed:

Railroad Line	Yearly Capacity (in millions of tons)		900-Ton Trains		1,200-1,300-Ton Trains	
	RR	Pipe Line	Yearly	Daily	Yearly	Daily
Baku-Batumi	0.25	9.6	375	4	280	3/4
Baku-Makhachkala	2	-	3,000	8	2,250	6
Makhachkala-Grozny	3	1.8	4,500	12	3,375	9
Grozny-Armavir	6	1.6	9,000	24	6,750	18
Armavir-Donets Basin	6.2	1.2	9,300	25	6,975	19
Maykop-Tuapse	0.8	1.6	1,200	3	920	2-3

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## FROM URAL-VOLGA REGION WESTWARD

OKW/Rüstungs- und Wirtschaftsamt (Armament and Economic Staff High Command of the Armed Forces) reported, in December 1941, on the transportation of petroleum from the Ural-Volga region to the western industrial areas (GMS Document No W1/ID 2.835).

The routes, which are available for the shipping of petroleum products from Sterlitanak and Ishimbay, can be divided into three main sections. The most eastern section reaches from Ishimbay to Ufa, the second section consists of the routes from Ufa to the Volga River, and the third section comprises the routes west of the Volga river.

Section 1

Shipments from Sterlitanak and Ishimbay to Ufa can be made as follows:

Via the petroleum pipe line with a yearly capacity of 1.7 million tons;

Via the single-track railroad line, 173 kilometers long;

Via river navigation on the Belaya, a tributary of the Kama River, possible only during high water (end of April to middle of May; during July and August);

Via the Ishimbay-Ufa highway which is seldom used.

Section 2

Petroleum can be shipped without reloading from Ufa to the Volga River on the railroad lines Ufa-Kuybyshev, 514 kilometers long, double-track, with a capacity of 10 million tons per year; and Ufa-Ulyanovsk, 615 kilometers long, single-track, with a capacity of one million tons per year. Since the capacity of the Ishimbay-Ufa railroad line is not very high, most of the petroleum will have to be loaded from the oil pipe line into railroad cars.

Shipping by boat down the Velya and Kama Rivers towards the Volga River, which is reached south of Kazan is also very important. Vessels up to 2,800 tons can be employed at Kazan.

Finally, the highway running northward from Ufa to the single-track Sverdlovsk-Kazan railroad line (maximum capacity of 4 million tons per year) should be considered. However, this route would necessitate two reloadings, the first from truck to railroad and the second, in Kazan, from railroad to ship.

Section 3

Shipping, west and northwest, from the Volga ports follows the upper Volga River and subsequently the Mariinsk Canal System. However, this canal system was built in 1811 and is now obsolete and neglected. A trip from the upper Volga River near Rybinsk to Leningrad takes 30 days or more. The canals can accommodate 2 to 2.5 million tons per season (180 days) but are navigable only for ships with a maximum capacity of 800 tons; therefore, shipments have to be reloaded from the much larger Volga ships. The canal system includes more than 40 different, large but obsolete, sluices. Complete renovation of the whole system has been planned.

The Tikhvin canal system is of no value for petroleum shipments because of its shallow depth (0.3 meter).

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The western railroad lines, including those from Kazan and Ulyanovsk to Moscow, 755 and 975 kilometers respectively; from Kuybyshev to Moscow, 1,084 kilometers; the lines running via Penza and Tula to Smolensk, 1,351 kilometers; and via Penza, Balashov and Gorodop to the Ukraine, can be used for petroleum shipments.

#### Conclusion

Petroleum shipments to the west are possible over a number of routes. Railroads, however, provide the best means of transporting petroleum over the 1,700 kilometers to Moscow as well as to destinations farther west. The capacity of all the railroad lines, or even of the Ufa-Kuybyshev-Moscow railroad line alone, would be sufficient to handle fully the yearly production. However, an extremely great demand for tank cars would arise because of the length of the railroad lines.

Shipments via the inland waterways, Kama River-Volga River-Mariinsk system, take much longer than rail shipments and are limited by the long period of ice, e.g., the Belaya River freezes from 18 November until 17 April, the Kama River from 17 November until 24 April. Moreover, this route requires at least one extra reloading, onto ships suitable for the Mariinsk canal system, while railroad tank cars or tank trucks can be loaded directly from the petroleum pipe line in Ufa.

#### BASHKIR PETROLEUM BASES

S. Tarabukin, director of the Central Laboratory of the Bashkir Office of the "Glavneft'esbyt" (Main Administration of Petroleum Markets) described the Bashkir petroleum bases in his report of March 1942 as follows. (GMOB Document No W1/ID 2.835).

The Bashkir bases provide the industrial and agricultural installations of the Bashkir ASSR with the necessary fuel and lubricating oils. The 18 bases controlled by the Bashkir office of the "Glavneft'esbyt" are located mainly on rivers and at stations of the Kuybyshev Railroad System as follows:

Six petroleum bases on the Ufa-Kuybyshev railroad line -- Chishmy, Shingak-Kul', Davlekanovo, Shafranovo, Akseynovo, and Beleley.

Two petroleum bases on the Ufa-Ulyanovsk railroad line -- Blagovar and Tuymaza.

Three petroleum bases on the Ufa-Zlatoust railroad line -- Chernikovka, receiving point of the Ufa petroleum distilleries; Iglino, and Suleya.

Three petroleum bases on the Ufa-Sterlitamak railroad line -- Sterlitamak, Allaguvat, and the receiving point of Ishimbay.

Three petroleum bases on rivers -- Toportlino and Birek on the Belaya, and Kara-Idel' on the Ufa.

One petroleum base in Ufa, which serves as a central distribution and transshipment base

#### Ufa Petroleum Base

This transshipment base is the largest in the Bashkir ASSR and is most conveniently located on the Belaya River not far from the railroad station. The spur line from the railroad station to the base accommodates petroleum products in tank cars and barrels. The base is also equipped with installations to receive such petroleum products as kerosene, mazut, ligroin, and engine fuel from barges, which arrive from Baku plants via Astrakhan. However, transportation

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on the river is possible only in the spring at high-water time. By railroad the base receives petroleum products from Baku, Groznyy, Makhachkala, the Saratov petroleum distillery, the Batraki transshipment base on the Kuybyshev railroad line, Ishimbay, and other places.

Because of reloading and careless handling at shipping points, petroleum products, particularly automobile and other special oils, arrive diluted. The Ufa base is equipped with a special installation to extract water. The watery oils are warmed by a special process and then air is blown through them. The base is equipped with a number of pumps.

Additional installations include:

- (1) The Central Laboratory of the "Bashneft'sesbyt" (Bashkir Office of the Administration of Petroleum Markets), housed in a separate building and furnished with all necessary equipment;
- (2) A coöperage to manufacture and repair wooden barrels for lubricating oil and engine fuel;
- (3) Pumping installations, to supply fuel (mazut) to the vessels of the State Steamship Line on the Belaya River, sailing between Moscow and Ufa, Kazan and Ufa, Ufa and Gorki, etc.;
- (4) Aviation gasoline tanks, owned by the commercial airport.

The storage tanks of the Ufa petroleum base are insufficient for the large amount of incoming petroleum products. As a result these products often deteriorate, because they cannot be kept in separate pipe lines and tanks. The base has 15 storage tanks for light and dark petroleum products, each with a capacity of 5,000 cubic meters.

#### Regional Petroleum Bases in Bashkir ASSR

Although most of the petroleum bases have been operating for some time the following five bases were established recently: Allaguvat, Iglino, Ishimbay, Sterlitamak, and Chernikovka. All the regional bases have storage tanks only above ground.

Most of these petroleum bases are equipped with automatic outlets to transfer the oil products from tank cars to storage tanks. Moreover, each base has "Allveiser" hand pumps. Discharge of petroleum products takes place by means of special equipment, which includes automatic cranes at the larger bases. The newer bases also have special distributing apparatus.

Except for the Ishimbay and Chernikovka bases, these regional petroleum bases have no heating installations, because the lubricating oils are usually shipped in wooden barrels. On the other hand, the storage of the oil products in barrels is not satisfactory. Inasmuch as buildings for storing petroleum products are lacking at most of the bases, the oil is kept in the open and resulting losses are exceptionally high.

Protection against fire at these bases is rather primitive; only the larger ones, such as those in Ufa, Ishimbay, and Chernikovka, have foam-type fire extinguishers. Each base is surrounded by an earth wall.

#### STORAGE AND LOADING FACILITIES OF ODESSA, KHERSON, OSIPENKO, AND MARIUPOL

In a final report of November 1941, a German petroleum exploitation unit discussed the storage and loading facilities of Odessa, Kherson, Osipenko, and Mariupol' (GMS Documents No W1/ID 2.1199b, 2.1134, 2.383).

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Odessa

The installations in Odessa consisted of the harbor, five tank farms, and a cracking plant, which were connected with each other by pipe lines and railroad sidings.

## 1. Petroleum Harbor

## a. Channel and Wharves for Tankers

Depth of the channel up to the wharves is 9-10 meters, suitable for 12,000-ton tankers. The four wharves, including pipelines and valves, are almost completely intact, or can be repaired without great difficulty. The pipe lines run directly to five tank farms (No 1-5).

Originally two 12,000-ton tankers could be unloaded simultaneously in 24 hours. At present the harbor basin is not navigable, because the harbor was mined and has not yet been quite cleared. Furthermore, sunken ships, floating docks, cranes, locomotives and other vehicles in great numbers obstruct navigation, however every possible clearing operation will be undertaken.

## b. Port Railroad Sidings

All sidings are completely intact. They run up to tank farm No 4 and are suitable for large-scale loading. Original loading capacity of tank farms No 2 and 3 was a maximum of 900 tank cars daily, equaling 13,000 tons.

Partial respiking of the sidings in the entire port area and of the railroad lines, 6-8 kilometers long, leading to the freight station should be possible without any difficulty. One track of the L'vov-Zhmerinka-Balta-Odessa railroad line was converted to standard gauge for a distance of 200 meters in front of the main railroad station of Odessa. The second track can be traveled at present only up to Razdelnaya, 70 kilometers from Odessa, and will remain wide-gauge for the time being.

On the standard gauge track, six trains daily can travel immediately, 12 to 24 trains daily after reconstruction is completed. A period of 5 weeks after arrival of material and labor is calculated to be required for the construction work. On the wide gauge track, six trains daily will be able to travel after reconstruction is completed.

The military transportation commander in Odessa was ordered to effect railroad loading capacity of 200,000 tons per month as soon as possible.

## c. Tank Farms No 2, 3, and 4

Tank farm No 2, originally consisting of eight tanks with a total capacity of 16,000 tons, as well as all its buildings and machinery, was completely destroyed by blasting and fire. The sheet metal of the burnedout tanks cannot be utilized.

Tank farm No 3 has a total capacity of 10,500 tons. Tanks No 1 to 4 were rendered useless through blast from the interior (no fire). Tanks No 5 and 6 are being constructed; for tank No 5 all required sheet metal is available. It is possible that one new tank of 4,000-ton capacity can be constructed from the remaining sheet metal parts of tanks 1 and 2. The same is true for tanks No 3 and 4 (640 tons). The pipe lines and valves are entirely undamaged.

The pump house itself was not destroyed. However, of five large steam pumps only the housing and cylinder covers are left; whole pistons, flap

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valves, and component parts of link motion were dismantled and cannot be found. The pipe system in the pump house seems to be in order.

The boilerhouse was completely destroyed. The steam pipe system from the boilerhouse is intact and can be extended to the boilerhouse of the adjacent power plant. The tank-car-loading installation, for simultaneous loading of nine tank cars, is serviceable.

Transshipment from ships at tank farm No 3 can take place very soon as follows:

(1) Directly to tank cars by means of ship pumps and the available three pipe lines via the tank-farm installation; however, weighing of empty and loaded tank cars has to be done on the railroad scales. Such a procedure will be rather uneconomical, inasmuch as the ship pumps will have to be stopped after filling each tank-car unit, thus delaying the unloading considerably.

(2) Separate unloading from ship to storage tank and subsequent loading from storage tank to tank car; this would result in a higher rate of transshipping and, also, in shortened delivery time for the ships. Tank capacity of 10,000 tons at this tank farm will be made available and the pump house will be repaired as soon as possible. Dismantling of storage tanks at the refinery and their reconstruction here should be considered.

#### d. Tank Farm No 1

The entire terrain has been flooded one meter deep, in some places considerably deeper, as a result of dam demolition.

Tank farm No 1 with its direct pipe lines to the wharves of the petroleum harbor used to handle the greatest amount of gasoline, kerosene, and gas oil transshipments. It can be easily expanded, especially since expansion work (tank space, new pump house, railroad sidings) had already been projected or even started. Damage to the equipment is not so heavy as to make resumption of operations impossible.

For storage purposes (not counting the smaller tanks), 27 tanks with a total capacity of 95,000 tons were originally available; 11 tanks with a total capacity of 37,000 tons are now completely useless; thus 16 tanks with total capacity of 58,000 tons remain for possible usage. Of this total four tanks with a total capacity of 15,000 tons would be serviceable after overhauling and 11 tanks with a total capacity of 43,000 tons must be repaired. Four tanks with a total capacity of 14,400 tons were under construction. Sheet metal parts of the unserviceable tanks could be utilized for repairs. A great number of smaller tanks are serviceable. The destroyed and damaged tanks were exploded when empty and without fire.

Within the tank farm pipe lines to the port (with the exception of one line), railroad sidings, and tank car loading installations are in order as far as can be determined. A gasoline pump house was completely destroyed by explosion. A second pump house with three electric motors, the transformer station, and the adjacent boilerhouse (two boilers) including their machinery are apparently undamaged and should be able to resume operation. Additional steam could be obtained from the boilerhouse of a hardware factory located on the adjacent premises.

The drum filling sheds and their filling tanks are entirely intact.

Repair work for a capacity of approximately 20,000 tons is estimated to require 2 to 3 weeks after the water flows off. Tank farm No 1 could be ready for operation by spring of next year, since only by then could the terrain be completely drained. The tank farm is located at the lowest point of the flooded area, area 4 x 5 kilometers, covered with approximately 20,000,000 cubic meters of flood water. The dam breaks occurred in four

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places (each 50-70 meters long) at a lake approximately 6-8 kilometers north of Odessa.. The water level must be lowered by additional drainage. According to estimates, 60 work days will be required to close the breaches, and 75 work days to pump out the low terrain, which is approximately 1.5 meters below sea level and so without natural drainage to the sea.

e. Tank Farm No 5

Tank farm No 5, belonging to the refinery, is also located in the flooded area and is connected by pipelines with the port and the refinery. On the spot investigation was not possible, but persons familiar with the depot report that only tanks No 1 to 3 were destroyed and are unserviceable. With the exception of flood damage all other equipment is said to be undamaged or to have been dismantled. As to resumption of operations, the time requirements will be the same as for tank farm No 1.

f. Refinery

The refinery was shut down on 26 June 1941 and completely dismantled during July and August 1941. With the exception of 3 columns which remained in the plant the entire equipment was loaded on five railroad trains. Four of these trains, according to statements of refinery employees, went to Stalingrad, but the last train was held back because of the encirclement of Odessa. This train was found in the station next to an exploded ammunition train; nothing remained except 3 columns, several pipe plates. Of the entire plant equipment, only the 6 columns are on hand.

Since the Kherson and Odessa installations were allegedly built alike and all auxiliary plants of the Kherson installation are in order, it should be possible to utilize these columns for the reconstruction of Kherson facilities.

All tanks as well as the pipe lines and valves, are undamaged with the exception of one burned-out 1,200-ton gasoline tank.

Available Tank Space

2 tanks at 4,600 tons --	9,200 tons
3 tanks at 2,900 tons --	8,700 tons
7 tanks at 1,200 tons --	8,400 tons
2 tanks at 280 tons --	560 tons
5 tanks at 180 tons --	900 tons
5 tanks at 150 tons --	750 tons
Total	28,510 tons

1 tank under construction	4,600 tons
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Grand Total	33,110 tons
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Several tanks still contain rather large amounts of cracking residue. All pumps and boiler house equipment were removed. No damage to the railroad sidings was found.

Since the connection of this installation with the petroleum harbor goes through the flooded tank farm No 5, transshipping from boat to tanks cannot be expected for several months.

g. Tank Cars

Approximately 100 tank cars including a number of 50-ton cars, were found. Although most of them were made unserviceable by breaking of the axle boxes, 50-60 in a usable condition should be available, including 37 at tank farm no 1.

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## 2. Kherson

Petroleum installations in Kherson consist of the port and the refinery. Some processing installations were disassembled and evacuated. The following installations suffered comparatively little damage and can be used immediately: power station with 2 boilers, 2 pumping houses, tank-filling installation with pumps, 80,000 cubic meters of storage space of which 7,000 cubic meters of newly constructed storage space lacks valves. Construction of additional 26,000 cubic meters of storage space had begun and large quantities of sheet metal for this purpose had been stored at the refinery. The plant is connected with the port installations by an 8-kilometer long pipe line. A second pipe line, 290 millimeters in diameter, is about half completed, and a third one, 150 millimeters in diameter is about one quarter completed.

The harbor is equipped with 3 landing bridges for tankers up to 6,000 tons; 3 additional landing places are located at the pier. The pumping station of the harbor is equipped with 2 electric pumps, one of which is in working condition, and 2 steam pumps, both of which are without valve gears.

The boilerhouse with 3 boilers is in good condition. The current supply of the transformer is interrupted. Three storage tanks, each of 4,800 cubic meters capacity, are available, one of which is slightly damaged. A tanker, of 500 tons capacity, provides floating storage space.

## 3. Osipenko (formerly called Berdyansk)

The petroleum installations consist of two separate systems. System No 1 includes the port pier, an intermediate depot, and the cracking plant. System No 2 is a small depot for finished products for local requirements.

## a. System No 1

Distilled crude oil from Maikop, Groznyy, and Baku was brought into the port by 4,000 to 6,000-ton tankers, and from there pumped by ship pumps through two pipe lines, 200 millimeters in diameter, to the intermediate depot. From the intermediate depot the raw material was forced by electric pumps into the cracking plant. In winter the raw material was also transported to the plant by truck.

At present 55,000 cubic meters of storage space in the plant and 17,600 cubic meters in the intermediate depot are available. An additional 22,000 cubic meters of space can be repaired within 6 to 8 weeks, making a total of 95,000 cubic meters of available storage space. The cracking installation of the plant had been completely disassembled. Of the four steam boilers only one was found but it will be in working condition as soon as the furnace (either for oil or coal) can be rebuilt. Power can be supplied by the municipal power plant. The port has railroad connections.

## b. System No 2

This depot is located at the eastern edge of the city, directly on the river and served as depot and distribution point for finished products. A larger storage tank of 3,000 cubic meters capacity was destroyed; a smaller one of 1,000 cubic meters capacity was disassembled for evacuation and damaged. Ten smaller storage tanks of 15 to 50 cubic meters capacity have partly damaged roofs, and four new storage tanks of this kind had not yet been assembled. There are two electric pumps of 60 cubic meters capacity each and several hand pumps. There is one filling room for petroleum and one for lubricating oil. Petroleum was reloaded via a pipe line and subsequently via filling installations into tank cars and barrels.

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## 4. Mariupol'

## a. Processing Installations

The distillery for crude benzole, located at the Azov Steel Works has the following storage facilities:

3	storage tanks of 1,000 cu m each	--	3,000 cu m
2	" " "	300 cu m "	-- 600 cu m
6	" " "	250 cu m "	-- 1,500 cu m
9	" " "	150 cu m "	-- 1,350 cu m
9	" " "	50 cu m "	-- 450 cu m

Total 6,900 cu m

The storage tanks were filled with light products.

## b. Storage Yards

An unloading installation for ships is located on the western side of the port of the Azov Steel Works, east of Mariupol' harbor, and has three storage tanks, totaling 2,000 cubic meters. It is connected with a 4,000-cubic meter storage tank for mazut and is able to unload sea vessels up to 5,000 tons. The depth of the water of this port is 25 feet. The installation was intended only to supply the Azov Steel Works with mazut and has a railroad siding, a tank-car-filling installation connected with a heatable pipe line, and a pumping installation.

Storage facilities for 25,000 cubic meters of oil are located on the premises of the Ilyich Steel Works. They can be reached only by railroad and are intended for use of the steel works.

A small tank farm, with a capacity of 1,500 cubic meters, is located some distance from the port, directly in the center of the city. This farm was intended chiefly for gasoline and automobile oils and consists of the following storage facilities:

One	storage tank, underground, capacity	250 tons for	Diesel oil
"	" " " above ground, "	470 "	" kerosene
"	" " " " " "	180 "	" gasoline
"	" " " " " "	50 "	" tractor fuel
"	" " " " " "	26 "	" tractor fuel
"	" " " " " "	26 "	" Diesel fuel/trucks
"	" " " " " "	45 "	" " "
"	" " " " " "	18 "	" gasoline
Two	" " " " " "	45 "	" "

The storage yard was supplied by tank cars only and is equipped with filling installations for barrels and tank cars. The installation is ready for use.

## c. Transshipment Installations

A bridge, at the eastern pier of the Mariupol' harbor, is accessible to ships with a maximum draught of 25 feet and is connected by two pipe lines, 6 and 8 inches in diameter, with a double-track loading installation for tank cars, located 200 meters from the bridge. One pipe line has been used for mazut, Diesel fuel, and kerosene, the other for lubricating oil only. The eastern track has 8 outlets, the western track 6 outlets and a storage tank with heating coils. The outlet installations are also accessible to street vehicles. In addition they are connected by a temporary pipe line above ground for loading small vessels at a nearby pier.

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for small ships. There is no pumping installation; loading must be done by pumps of the loading ships.

#### 5. Summary

Processing of crude oil can take place only in Mariupol' at present, while Osipenko and Kherson exceed Mariupol' as far as availability of storage space is concerned. Odessa cannot be considered at present and will not have half of the storage space of Osipenko, even after the flood damage has been eliminated and the storage tanks repaired.

The location of Osipenko near petroleum fields, pipe lines, large petroleum export ports, and railroad lines after their reconstruction, makes this city appear to be the most important transshipment point on the northern coast of the Black Sea and Sea of Azov. Osipenko and Kherson, although 300 kilometers further from the petroleum fields, serve the agricultural and industrial enterprises of the Ukraine. In both cities reconstruction of processing plants, each with a capacity of 300,000 tons of crude oil and 200,000 tons of mazut per year, is planned.

#### CRIMEAN PENINSULA

In December 1941 the German petroleum exploitation unit in the Crimean Peninsula reported that all transshipment facilities had been destroyed (GMBB Document No W1/ID 2.383).

The unloading installations in the port of Kerch were damaged to such an extent that their reconstruction did not seem to be profitable in the near future.

In Feodosiya, the two tank farms and the pier for tankers were completely destroyed. Tank farm No 1 was located on the right side of the highway to Kerch and had a storage capacity of 15,000 cubic meters, including four 3,000-cubic-meter tanks. Tank farm No 2, located at the edge of the city, left from the highway to Kerch, reportedly had a capacity of 30,000 cubic meters. Its installations, including the boilerhouse, were badly damaged; its machinery was disassembled and evacuated; only the tank-car-filling installation with 20 to 30 outlets was intact.

Yalta's destroyed loading facilities are unimportant because of lack of any railroad connection. Yalta has a pier of concrete blocks; 20-meters wide and 450-meters long. The depth of the water at the pier is 7-9 meters, and four to five large steamers can dock at the same time. An old pier, from the foot of the new pier to the mouth of the Yalta River, is 190 meters long; the depth of the water along its side is 4 to 5 meters. The landing places for tankers are connected with a nearby tank farm by a double pipe line for heating oil and petroleum, 6 inches in diameter, which is in working condition.

Another petroleum exploitation team reported in 1942, that the petroleum installations in Arzavir include a pumping station, storage tanks, unloading facilities, and pipe lines.

The pumping station consists of two pressure pumps, each operated by two 4-cylinder Diesel engines, "Kolonna" type. It also contains two 2-stage compressor installations, which produce compressed air to start the 400-horsepower Diesel engines. This installation has not been destroyed and can be put into operation immediately.

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The tank farm consists of five subterranean storage tanks with a total capacity of 900 cubic meters and ten storage tanks above ground with a total capacity of 38,000 cubic meters. Seven storage tanks with a total capacity of 26,000 cubic meters were not destroyed and are ready for immediate use. The storage tanks are connected with two unloading facilities, one with 25 double outlets and one with 30 single outlets, which are also in good condition and can be used at once.

The Armavir-Groznyy pipe line was investigated up to Sovetskaya pumping station. The Armavir-Vodrazdel section operates under a pressure of 25 atmospheres. Its four pumping stations are located at Vodrazdel, Gorkiy, Podkumok, and Sovetskaya. The Gorkiy and Sovetskaya installations were completely evacuated; the other two were in operation until the German advance. Each installation consisted of three units with one 300-horsepower Diesel engine, each coupled through transmission gears with three plunger pumps. Besides the necessary auxiliary equipment each station had three storage tanks of 6,500 cubic meters each. The three storage tanks in Vodrazdel were destroyed or burned; the Diesel engine and pumping units damaged when operated for 2 hours without cooling water and lubricating oil; however, their restoration has already begun. In Podkumok one storage tank was burned, one pumping unit severely demolished, and a second pump slightly damaged. Two Diesel engines and one pump are in good condition.

#### UKRAINIAN PETROLEUM BASES

A petroleum investigation unit of the Economic Staff of Army Group "South" discussed in detail the condition of the Ukrainian petroleum bases in Novomoskovsk, Pavlograd, Sinel'nikovo, Kil'chen', Prosyanyaya, Mezhevaya, and Nizhne-Dneprovsk in March 1942 (GMDS Document No W1/ID 2.659).

These petroleum bases were controlled by the Ukrainian Office of the Main Petroleum Administration in Kiev. Their petroleum products usually came from Baku, Groznyy, Odessa, Nikolayev, Osipenko, and the rayon petroleum base at Nizhne-Dneprovsk, and were subsequently directed to MTS's, kolkhozes, sovkhoses, and various industrial plants in the vicinity. All these bases have railroad connections with the nearby main railroad lines, but except the one in Nizhne-Dneprovsk, have no waterway connections.

#### Novomoskovsk Petroleum Base

This petroleum base, in partial operating condition; had an estimated yearly turnover of 6,000 tons, although the demand used to be twice as high.

Its 15 storage tanks are above ground. Tank No 3 was severely damaged and cannot be repaired; tanks No 1, 4, 5, 6, 13, 14, and 15 were pierced by shell fragments but can be repaired. The remaining tanks, No 2, 7, 8, 9, 10, 11, and 12, can be put into operation immediately; however, their storage capacity is limited, totaling only 141 tons. Eight additional smaller tanks, from 2 to 6-ton capacity are located at the tank-car-loading installations, 450 meters from the storage yard. The small tanks have no pipe connections. All storage tanks are without mixing devices and cannot be heated.

Originally the following storage tanks were erected:

Storage tank No 2 with a capacity of	105	tons (gasoline)
" " " 3 " " " "	105	" (gasoline)
" " " 6 " " " "	160	" (kerosene)
" " " 15 " " " "	50	" (kerosene)
" " " 4 " " " "	105	" (ligroin)
" " " 5 " " " "	105	" (ligroin)
" " " 1 " " " "	1,130	" (Diesel fuel)
" " " 13 " " " "	22	" (Diesel fuel)

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Storage tank No	14	with a capacity of	22 tons	(Diesel fuel)
" " "	7	" " "	" 13	" (petroleum)
" " "	9	" " "	" 27	" (petroleum)
" " "	9	" " "	" 4	" (petroleum)
" " "	10	" " "	" 4	" (petroleum)
" " "	11	" " "	" 4	" (petroleum)
" " "	12	" " "	" 4	" (petroleum)

Original total capacity 1,860 tons

The railroad siding (Russian standard gauge) branches off from the Dnepropetrovsk-Kharkov line, one kilometer from the Novomoskovsk railroad station, and can accommodate three tank cars. It has three unloading facilities for tank cars, which can empty simultaneously two tank cars containing the same light product and one tank car of petroleum. There are no facilities for filling tank cars.

The pipe line from the two unloading connections for light products leads to the smaller pump house, which is located close to the railroad track. Two 450-meter-long pipes lead from this pump house to the petroleum base. The gasoline engine and the pump has been removed from the latter. A hand pump for light products, which was formerly kept in reserve, is now attached to one of the unloading facilities.

Petroleum was originally emptied also by means of a hand pump, which was attached to the emptying facilities. A 450-meter-long pipe line leads from the latter directly to the petroleum base. All three pipe lines are underground and 4 inches in diameter.

The barrel-filling building has a total of six outlets for petroleum, Diesel fuel, kerosene (2 outlets), gasoline, and ligroin. The discharge pipe of the Diesel storage tank No 1 had been disassembled; the other pipes could be recovered and reassembled easily. A barrel scale is also installed in the barrel-filling house. Products were shipped in barrels only, because there were no facilities for filling tank cars and tank trucks.

#### Pavlograd Petroleum Base

This petroleum base, in partial operating condition had an estimated yearly turnover of 12,000 tons; although the demand is said to have been considerably higher.

Of the following 12 storage tanks which had been erected above ground, 5 were too greatly destroyed to be repaired:

Storage tank No	1	with a capacity of	120 tons	(gasoline)
" " "	10	" " "	40 "	" (gasoline)
" " "	11	" " "	105 "	" (tractor fuel; unserviceable)
" " "	12	" " "	180 "	" (tractor fuel)
" " "	9	" " "	450 "	" (kerosene; unserviceable)
" " "	3	" " "	35 "	" (Diesel fuel; unserviceable)
" " "	4	" " "	27 "	" (automobile oil; unserviceable)
" " "	5	" " "	18 "	" (automobile oil; unserviceable)
" " "	6	" " "	25 "	" (automobile oil)
" " "	7	" " "	50 "	" (petroleum)
" " "	8	" " "	50 "	" (petroleum)
" " "	2	" " "	9 "	" (kept in reserve)

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A railroad siding (German standard gauge) leads directly from the Pavlograd railroad station on the Zaporozh'ye-Pavlograd railroad line to the petroleum base, which is located 300 meters from the railroad station. The three unloading facilities for tank cars, one for light products (gasoline, ligroin, kerosene), the second for automobile oil, and the third for petroleum, can handle simultaneously one tank car with light and one with heavy products. Two additional emptying connections have not been used for years. The pipe lines lead to the old pump house which was used prior to the construction of the motor-driven pump house and is equipped with two hand pumps, one for light and the other for heavy products. There are no facilities for filling tank cars.

The new pump house is equipped with two pumps: a piston pump with a capacity of 4 tons per hour for unloading heavy products (automobile oil and petroleum) and a centrifugal pump with a capacity of 20 tons per hour for light products. All pipe lines for unloading are 4 inches in diameter. Emptying a tank car containing 30 tons takes about 2 hours. Six tank cars can be accommodated on the premises, still more at the railroad station.

The barrel filling building has three outlets, two of which are damaged, leading from all storage tanks. However, only the ones for Diesel fuel, automobile oil (two outlets), ligroin, kerosene, and gasoline are in working condition. One pipe line branches off from the damaged pipe to the destroyed kerosene tank No 9 and leads to the filling installation for kerosene tank cars. The pipe line to the former filling installation for gasoline tank cars can at present be used for all light products. A barrel scale of one-ton limit is installed in the building. Products were shipped in barrels and tank cars.

#### Sinel'nikovo Petroleum Base

This petroleum base is not in operating condition; its yearly turnover was estimated at 15,000 tons. It is equipped with eight storage tanks above ground:

Storage tank No	2	with a capacity of	235 tons	(gasoline)
"	"	1	"	105 "
"	"	3	"	235 "
"	"	5	"	105 "
"	"	6	"	19 "
"	"	7	"	17 "
"	"	8	"	17 "
"	"	4	"	135 "
				(petroleum)

Total capacity 868 tons

Storage tanks No 1 to 5 rest on truncated conical stone bases, storage tanks No 6 to 8 on brick bases. Tank No 1 has a damaged roof; tank No 2 has a small hole in the casing about a third of the way down from the top. These minor damages can easily be repaired. The storage tanks are not equipped with mixing devices and cannot be heated.

The petroleum base is connected with the Dnepropetrovsk-Zaporozh'ye and Zaporozh'ye-Pavlograd railroad lines via a railroad siding (German standard gauge), located between Sinel'nikovo stations I and II. Five outlets can be used for unloading tank cars: three for light products (gasoline, ligroin, kerosene) and two for heavy products (automobile oil, petroleum). There are no separate filling installations. However by switching the pipes in the pump house, the emptying procedure can easily be converted into a filling action. Normally one, two, or even three tank cars with a light product and one with a heavy product can be emptied or filled simultaneously; although both actions cannot take place at the same time. Twenty to 25 tank cars can easily be accommodated on the railroad siding and at the railroad station.

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The pump house is located close to the railroad siding and is equipped with two pumps: a centrifugal pump with a capacity of 40-50 tons per hour for light products and a piston pump with a capacity of 30-40 tons per hour for heavy products. Both pumps are operated by a gasoline engine and are now in working condition. The pipe lines for petroleum and automobile oil are 6 inches in diameter, the others are 4 inches in diameter. Filling and emptying a tank car of 30 tons takes about 1½ hours.

The barrel-filling building had outlets for ligroin, gasoline, kerosene, (2 outlets), engine oil, automobile oil, and petroleum. Although a part of the barrel-filling building was destroyed by bombing, the damaged outlets for gasoline and ligroin have already been repaired and installed in the undamaged part of the house. A barrel scale of one-ton limit is also installed in the building. Products are shipped in barrels only.

#### Kil'chen' Petroleum Base

This petroleum base will be in operating condition after having procured driving belts and a magneto for the gasoline engine. Its yearly turnover was estimated at 5,000 tons.

Six storage tanks, located above ground on truncated conical stone bases had been erected:

Storage tank No 4	with a capacity of	155 tons	(gasoline)
" " " 2	" " "	105 "	(tractor fuel)
" " " 3	" " "	155 "	(kerosene)
" " " 6	" " "	85 "	(gas oil)
" " " 5	" " "	85 "	(automobile oil)
" " " 1	" " "	105 "	(petroleum)

Total capacity 690 tons

None of the tanks can be heated or have mixing devices.

The railroad siding (Russian wide gauge) is located at the Kil'chen' railroad station on the Novomoskovsk-Krasnograd railroad line and is separated from the petroleum base by a highway. There are two unloading outlets: one for light products (gasoline, ligroin, kerosene) and the other for heavy products (automobile oil, petroleum). The yard is not equipped with filling facilities for tank cars. Only one tank car with a light product and one with a heavy product can be emptied simultaneously.

Light products are unloaded by a centrifugal pump, with a capacity of 20 tons per hour, located in the pump house and operated by a gasoline engine. The heavy products are unloaded by a hand pump, also located in the pump house. The pipe lines are 3 inches in diameter. Two hours are required to empty a tank car of 30 tons of gasoline, 6 hours for a tank car filled with automobile oil. The railroad siding and the railroad station can accommodate 25 cars.

The barrel-filling house is equipped with outlets for automobile oil, kerosene, gasoline, ligroin, and petroleum. Two barrel scales of one-ton limit each are located in this building. One pipe line from the kerosene and one from the ligroin system branch off just outside the barrel-filling building and lead to two tank car filling installations, an arrangement which makes it possible to load gasoline through the kerosene pipe and automobile oil through the ligroin pipe into tank cars. Both, barrels and tank cars, are filled by gravity flow from the reservoir.

#### Prosyanya Petroleum Base

This petroleum base is now in operating condition, its yearly turnover estimated at 10,000 tons.

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The following storage tanks had been erected above ground:

Storage tank No	3	with a capacity of	147 tons	(gasoline)
" " "	1	" " "	68 "	(tractor oil)
" " "	7	" " "	48 "	(tractor oil)
" " "	6	" " "	333 "	(kerosene)
" " "	5	" " "	29 "	(engine oil)
" " "	4	" " "	28 "	(automobile oil)
" " "	8	" " "	3 "	(automobile oil)
" " "	2	" " "	147 "	(petroleum)

Total capacity 803 tons

The roof of tank No 3 is damaged and the upper edge of the casing is rusty and leaking. The other tanks are in working condition, although the tanks cannot be heated and have no mixing devices. An iron tank with 2.5 tons of water for fire extinguishing purposes is located underground.

The railroad siding (German standard gauge) is located directly at the Prosyanyaya railroad station on the Chaplino-Stalino railroad line. It is equipped with two underground installations for emptying tank cars. They are connected with the petroleum base by two 500-meter long pipe lines. One pipe line, 3 inches in diameter, transports light products (gasoline, ligroin, kerosene) into storage tanks No 1, 3, 6, and 7 and another pipe line, 4 inches in diameter, heavy products (automobile oil and petroleum) into storage tanks No 2, 4, and 5. The small tank No 8 has no pipe connection. Because only one pump is available, the two pipe lines cannot be used simultaneously and only one tank car at a time can be emptied. An expansion of the unloading facilities for tank cars is possible; however there are no filling facilities for tank cars.

The pump house is equipped with a piston pump with a capacity of 18-20 tons per hour. This pump is operated by an 18-horsepower petroleum engine with 375 rpm and is located in an adjoining room. The centrifugal pump is not connected, but can easily be put into operation. In addition, a hand pump is available for an emergency. Two hours are required to empty one tank car with the piston pump. The railroad siding can accommodate ten tank cars, the railroad station even more.

The barrel-filling building has one outlet each for automobile oil, kerosene, engine oil, petroleum, gasoline, and two outlets for ligroin (tractor oil). A barrel scale, one-ton limit, is also located in this house. One pipe line each branches off from the gasoline, ligroin, and kerosene system in front of the filling room. These three pipes are connected with a hand pump, from which a pipe line leads to the tank-car-filling connections, located directly on the highway. Filling a tank car requires from 12-17 minutes. Products were shipped in barrels and tank cars.

#### Mzhevaya Petroleum Base

This petroleum base will be in working condition after a few parts have been procured. Its yearly turnover was estimated at 8,000 tons, but demands on it were reported to have been considerably higher (up to 20,000 tons).

Six storage tanks, have been erected above ground on truncated conical stone bases:

Storage tank No	3	with a capacity of	185 tons	(gasoline)
" " "	2	" " "	79 "	(tractor fuel)
" " "	4	" " "	85 "	(tractor fuel)
" " "	1	" " "	450 "	(kerosene)
" " "	5	" " "	85 "	(automobile oil)
" " "	6	" " "	83 "	(petroleum)

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Storage tanks No 3 and 4 have a few small holes caused by shell splinters in the upper part of the casing. After repair of these minor damages, the storage tanks will be in full working condition. The storage tanks cannot be heated and have no mixing devices. A concrete tank for 2.5 tons of water for fire extinguishing purposes is located underground.

The railroad siding (German standard gauge) is located directly on the Chaplino-Stalino railroad line, less than one kilometer from Mezhevaya railroad station towards Stalino. Tank-car-emptying facilities consist of 4 outlets: one for gasoline and ligroin, one for kerosene, one for petroleum (discharge pipe is missing), and one for automobile oil. The fourth outlet is damaged in several places. Expansion of the emptying installation is possible. The pumps are not very powerful. There were no tank-car-filling connections.

The pump house is equipped with 2 pumps: one centrifugal pump with a capacity of 25 tons per hour for light products (gasoline, ligroin, and kerosene), and one old piston pump with a capacity of 4 tons per hour for heavy products (petroleum and automobile oil). These two pumps are operated by a one-cylinder Diesel engine located in an adjoining room. Four hand pumps are kept in reserve. The pipe lines are 3 inches in diameter. One tank car filled with light products and one with heavy products can be emptied simultaneously. Emptying the car filled with the light product takes about one hour; the heavy, 6-8 hours. Twenty to 25 tank cars can be accommodated in the storage yard or at the railroad station. Products were shipped in barrels and tank cars.

The barrel-filling building consists of two rooms: a small one for gasoline, and a larger one with outlets for kerosene, automobile oil, petroleum and ligroin. A barrel scale of one-ton limit is also located in this room. A kerosene and a ligroin pipe line inside the filling room branch off from the main pipe lines and lead to two outlets on the outside wall of the house for filling tank cars. The tank cars and barrels are filled by gravity flow from the reservoirs. The filling of one tank car takes 10 to 15 minutes when the reservoirs are full.

#### Nizhne-Dneprovsk Petroleum Base

This petroleum base is partly in operating condition. Storage tanks and pipe lines had been extensively damaged by bombing and artillery fire. Storage space for 1,200 tons has already been restored; recovery of storage space for a maximum of 5,000 tons is planned for the end of January 1942, up to 7,000 tons for the end of March 1942. Altogether storage capacity of 11,000 tons can be restored. Before the war, the yearly turnover was estimated at 100,000 tons with a total storage capacity of 35,000 tons. All the storage tanks are above ground, cannot be heated, and have no mixing devices.

The following storage tanks are serviceable:

Storage tank No 9 with a capacity of	500 tons	(gasoline)
" " " 10 " " "	130 "	(gasoline)
" " " 12 " " "	120 "	(gasoline)
" " " 5 " " "	375 "	(oil)
Storage tank with a capacity of	75 "	(oil)
Total capacity	1,200 "	

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The following can be restored:

Storage tank No	1	with a capacity of	900 tons
"	2	"	3,000 "
"	4	"	520 "
"	6	"	240 "
"	7	"	360 "
"	8	"	900 "
"	11	"	900 "
"	15	"	900 "
"	16	"	2,000 "
"	17	"	<u>100</u> "

Total capacity 9,825 tons

Storage tanks No 3, 14, 18, 19, 20, 21, and 22 cannot be repaired.

The Dnepr River has a landing pier, at which two barges can be loaded or unloaded simultaneously, and an anchorage for ten barges. At the landing pier are two pump houses containing one centrifugal pump without an engine and three piston pumps with gasoline engines whose capacity was reportedly 100 cubic meters per hour. Three elevated pipe lines, each 1,400 meters long and 12-15 centimeters in diameter, lead to the storage yard, which is equipped with a double-track railroad sitting to Uzel railroad station. (Russian and German standard gauge)

The storage yard has 30 unloading and 40 loading connections along the railroad track, thus enabling it to load or unload 30 tank cars simultaneously. A pump house located next to the railroad tracks contains one piston pump with a gasoline engine and one electric centrifugal pump, both with a capacity of 100 cubic meters per hour. The barrel-filling buildings have a total of 24 outlets for barrel filling and additional facilities for filling three tank cars at the same time.

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